of engravings and carvings of animals on bone and ivory have been found, as well as engravings and paintings on the walls of caves, in France and Spain; mural carvings in low relief are also known, outlines of bison traced on the clay floor occur in a cave at Niaux, and now clay figurines have come to light.

There can be little doubt that many of these works of art had what we now term a magico-religious significance. Artists are not likely to have carved, engraved, painted, or modelled in the black recesses of caves merely for the joy of expression, since few of their fellow-tribesmen would see their works of art, and then but imperfectly. The only adequate solution of the problem seems to be that these delineations and representations had a significance which was at the same time practical and religious, and it is possible that some at least of them were made for the purpose of enabling their originals to be captured, or may be, as in the case of certain Australian ceremonies, to increase their numbers; in either case, their significance would be more utilitarian than æsthetic.

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## *NOTES.*

We regret to have to announce the death of Mr. Henry Groves, at his residence at Clapham, on Saturday evening, November 2, at fifty-seven years of age, after an illness extending over many months. In conjunction with his brother James, Mr. Groves was widely known as possessed of exceptional acquaintance with the small but difficult group of the Characeæ, and the opinion of the brothers "H. and J. Groves" was constantly sought by botanists of all nations. It is understood that a volume on the British species, for issue by the Ray Society, is practically ready for the press. The most conspicuous task in which both brothers engaged was the editing of the ninth edition of Babington's "Manual of British Botany," which was in many respects remodelled, and came out in 1904. Mr. Henry Groves had served on the council of the Linnean Society some years since; at the time of his death he was again a councillor, and in certain questions he took a leading part. His death removes a loyal and devoted worker, whose place will not be easily filled.

Dr. Benjamin Boss, son of the late Prof. Lewis Boss, director of the Dudley Observatory, Albany, N.Y., has been appointed acting-director of that institution.

M. Emile Boutroux was on October 31 elected a member of the French Academy. The eminent French philosopher is honorary professor of modern philosophy at the Sorbonne, and director of the "Fondation Thiers," a residential college for post-graduate study. He is known as the author of numerous important philosophical works.

The eighty-seventh Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Sir James Dewar, F.R.S., Fullerian professor of chemistry, his title being "Christmas Lecture Epilogues." The lectures will be experimentally illustrated, and the dates and subjects are as follows:—Saturday, December 28, "Alchemy"; December 31, "Atoms"; January 2, 1913, "Light"; January 4, "Clouds"; January 7, "Meteorites"; January 9, "Frozen Worlds."

Owing to bad weather, the illuminated night flying and firework display that was to be held at the London Aerodrome, Hendon, on Tuesday, November 5, has been postponed until Saturday next, November 9. Special exhibition flights, speed and altitude tests will take place from 2.30 p.m. until dusk, and the illuminated night flying and firework display will be in progress from 7.30 p.m. until 10 p.m.

The series of lectures which the Selborne Society annually arranges will begin on November 11, when Lord Montagu of Beaulieu will preside, and Mr. Fred Enock will deal with "Fairy Flies and their Hosts." Among the subjects of other lectures are:—"Minor Planets," by Dr. A. C. D. Crommelin (January 20, 1913); "Fibres and Fibre Lore," by Mr. C. Ainsworth Mitchell (February 17); and "Byways in Biology," by Mr. James Saunders (March 3). The special children's lecture will be given by Mr. Spencer Fletcher on "Dew, Hoar-frost, and Clouds" (January 9).

The death is announced, at the age of seventy-two, of Dr. William Willard Daniells, the founder of the study of chemistry at the University of Wisconsin. In 1868 he was appointed to a chair in that institution, and established its first chemical laboratory, giving daily instruction to one student, and using an old carpenter's bench in the basement. Dr. Daniells continued in active work as the head of the chemistry department until 1907, when he became professor emeritus. He also conducted the weather bureau at the University, until this work was taken over by the U.S. Government. From 1872 to 1876 he was chemist to the Wisconsin State Geological Survey.

The Weber-Parkes prize (of 150 guineas and a silver medal), founded in 1895 by Sir Hermann Weber in memory of the late Dr. E. A. Parkes, and awarded every third year to the author of the best essay "upon some subject connected with the etiology, prevention, pathology, or treatment of tuberculosis, especially in reference to pulmonary consumption in man," has been awarded by the Royal College of Physicians to Mr. J. A. D. Radcliffe, pathologist to the King Edward VII. Sanatorium, Midhurst. The subject of the next essay, to be adjudicated upon in 1915, is an original research on the treatment of pulmonary tuberculosis with substances which are especially antagonistic to the specific organism and its products. This work must have been chiefly carried on since the year 1911. The following lectures will be given at the Royal College of Physicians during November:— Dr. Raymond Crawfurd will deliver the FitzPatrick lectures on "The History of Medicine" on November 7, 12, 14, and 19, the subject being "Echoes of Pestilence in Literature and Art"; the Horace Dobell lecture by Dr. C. J. Martin, on "Insect Porters of Bacterial Infection," will be delivered on November 21.

THE extension of the Manchester Museum was formally opened on Wednesday, October 30, by Mr. Jesse Haworth, the donor of the larger part of the cost of the new buildings, when Prof. Flinders Petrie delivered an address on the *raison d'être* for the study of Egyptology. The extension consists of a central building, 65 ft. long and 35 ft. wide, comprising basement, ground and first floors, the latter with a gallery 12 ft. wide all round. This central building is connected with the old museum by a bridge 12 ft. wide, at the level of the first floor, and, balancing the bridge in front elevation, is a low building 30 ft. long and 35 ft. wide, consisting of basement, ground and first floors, communicating with the corresponding floors of the central building. The larger room on the ground floor will be devoted to a museum of economic and applied geology, which will be practically an extension of the existing geological museum on the ground floor of the old building. The smaller room on the ground floor will contain the collections illustrative of anthropology, ethnology, and numismatics. The whole of the first floor and gallery will be given over to the exhibition of the valuable and extensive collection of Egyptian antiquities, and for those illustrating the allied civilisations of the Orient. These collections, which deal with the historic period of human development, will be directly connected, by means of the bridge, with those illustrative of Palæolithic and Neolithic man, which are exhibited on the first floor of the old museum. It has been possible, therefore, to add these important departments to the museum without any reorganisation of the existing collections, while at the same time they fall into their correct place in the general scheme of classification adopted in the museum.

FOR the third month in succession October was generally cold over the United Kingdom, although it was less so in the northern and western districts than elsewhere. At Greenwich the mean temperature for the month was 48°, which is 2° less than the average, but in both August and September the mean was more than 4° below the average. The mean maximum temperature for October at Greenwich was 57°, which is 1° below the average, and the mean minimum 39°, which is 4° less than the normal. The highest day temperature was 66°, which is the lowest October maximum since 1905. There were in all only nine days at Greenwich with the temperature above the average, and on three days at the commencement of the month the deficiency of temperature exceeded 10°. The aggregate rainfall at Greenwich for October was 1·86 in., which is 0·99 in. less than the average, and rain fell on fourteen days. The duration of bright sunshine for the month was 123 hours, which has only been exceeded twice in October in the last thirty years, and never by more than ten hours.

THE factors concerned in the ripening of cheddar cheese are discussed by Messrs. Hastings and Hart and Miss Evans in Research Bulletin 25 of the University of Wisconsin Agricultural Experiment Station. The ripening seems to be brought about first by the action of bacteria belonging to the *B. lactis acidi* group, and subsequently by that of another group of acid-forming bacteria, the *B. bulgaricus* group.

IMPORTANT studies on dietetics are being carried out by the U.S. Department of Agriculture. One of the latest bulletins (Yearbook for 1911) deals with the nutritional value of green vegetables. While they do not add greatly to the total nutrient and fuel values, they increase the wholesomeness of the diet in three ways, viz., by supplying necessary mineral matters less abundant in other food-stuffs, by supplying bulk desirable for the normal digestion of the more concentrated food materials, and by rendering the diet more varied and attractive.

A VALUABLE report on isolation hospitals, compiled by Dr. H. Franklin Parsons, has been issued by the Local Government Board. Many isolation hospitals all over the country have been inspected, and full details are given as to construction, cost, and maintenance, with plans. The utility of these hospitals is discussed, and the question of combination between adjacent authorities is considered. The architect of the Board (Mr. Kitchin) points out that the cost of a rod of stock brickwork in mortar has risen from 12*l*. 10*s*. in 1859 to 16*l*. 10*s*. in 1905 and 16*l*. 5*s*. in 1911. Suggestions are made for cheapening construction, *e.g.* by the use of steel or timber framework covered with patent slabs, which might result in a saving of 30 to 40 per cent., but this kind of construction is at present hampered by the building by-laws now in force.

THE effect of smoking on the physique of college undergraduates is discussed in a paper by Dr. Frederick J. Pack in *The Popular Science Monthly* for October, under the title "Smoking and Football Men." The author's reason for singling out football men for special study is that it is impossible to draw definite inferences from comparing students some of whom are athletes and some of whom are scholars, and, on the other hand, he considers that the football squad forms a very nearly homogeneous group on which observations can well be based. Further collections of statistics are given referring to the effects of smoking on scholarship as tested by examinations, and to the lung capacities of smokers and non-smokers. In every case the evidence is against smoking. In the football trials only half as many smokers as non-smokers were successful. In the case of able-bodied men smoking was associated with diminished lung capacity amounting to 10 per cent. Finally, in examinations it was found that about 70 per cent. of the candidates obtaining highest marks were non-smokers, while 70 per cent. of those obtaining lowest marks were smokers.

IN *The Nature Photographer* for October Mr. F. J. Koch gives an interesting photograph of a herd of chamois in the Alps, taken with a telephoto lens.

DR. C. C. HOSSÉUS, of Berchtesgaden, has favoured us with a copy of a paper from the *Nachrichtsblatten der Deutschen Malakozoologischen Gesellschaft* on land and marine shells collected during an expedition to the Malay Peninsula and Siam. The most important result appears to be the evidence of the molluscan fauna that the islands of Koh-Si-Chang and Koh-

Kam-Yei formerly constituted a portion of the Siamese mainland.

In a paper on the origin of asymmetry in Cetacea published in vol. xli. (pp. 45–54) of the *Anatomischer Anzeiger,* Prof. G. Steinmann argues that the horizontal tail-fin of that group has been produced by torsion from the perpendicular type characteristic of the Mesozoic saurians. As the author believes cetaceans to be a convergent group derived from three of the Mesozoic marine reptilian orders (Ichthyosauria, Plesiosauria, and Thalattosauria), it is, to say the least, not a little curious that a similar torsion of the tail-fin should have occurred in each group. The same author has also sent us a copy of a pamphlet, by himself, published by Engelmann, of Leipzic, and entitled Die Abstammungslehre, was sie bieten kann und was sie bieten."

The interesting and rare fresh-water alga *Phaeothamnion confervicolum* has recently been found near Edinburgh by F. L. M'Keever, who describes (Trans. Bot. Soc. Edinburgh, vol. xxiv) the first recorded appearance of this plant in Great Britain. The genus Phæothamnion has by the majority of recent systematists been placed at the base of the brown algæ, and may be regarded as one of the intermediate forms in the ascending scale of brown organisms arising from the Flagellata with brown chromatophores (Chrysomonads), and giving rise to the true brown algæ (Phæophyceæ), hence it is a type of special interest from the phylogenetic point of view. Hitherto this genus has been found only in Sweden, Germany, Austria, and Italy. As the alga disappeared from Mr. M'Keever's cultures before its zoospores could be carefully studied, it is to be hoped that the plant will be found again, and further investigations made in order to determine its systematic position and affinities with greater certainty.

Prof. W. E. Ford has edited the thirteenth edition of "Dana's Manual of Mineralogy" (New York: Wiley and Sons, 1912, price 8*s*. 6*d*. net), which continues to be one of our best elementary text-books. The photographic illustrations of actual specimens, printed as separate plates, are distinctly helpful. As is usual in the smaller works on mineralogy, crystallographic considerations remain somewhat loosely stated. The problem of isomorphism outside the cubic system is not touched on in the three pages devoted to the subject, and the statement on p. 11 that "in general the ratio of the intercepts of a crystal face upon the crystallographic axes can be expressed by whole numbers or definite fractions" is surely, in this abbreviated form, misleading. Useful tables for the determination of minerals occupy nearly seventy pages.

The Deutsche Seewarte has added another lustrum (1906–10) to the valuable results of the meteorological observations made at the stations of the second order under its control. The lustra previously dealt with cover the thirty years 1876–1905, and some of the former have already been combined into longer periods, *e.g.* in 1904 the results included the twenty-five years 1876–1900. The observations are made at 8h. a.m., 2h. and 8h. p.m., local time, and excepting at two stations, where the English-pattern (Stevenson) screen is used, the thermometers are installed outside suitable windows. The results are calculated for months, seasons, and the year.

A lengthy article (in Japanese) on observations of air currents appears in the Journal of the Meteorological Society of Japan (xxxi., No. 7, 1912). The author, Mr. Sato Junichi, describes some experiments which he carried out in January and February last on the summit of Mount Tsukuba (2925 ft.), both with small hydrogen balloons, known as "pilots," and with pyrotechnic balloons. The latter, devised by himself, are balloon-like firework pendants, which are released at various heights, determinable from the nature and quantity of explosives used. It is claimed that whereas "pilots," being released at ground-level, are at the mercy of surface winds from the start, the firework balloons are carried through the lower strata and begin their journey several hundred metres high. For the observation of these balloons the author uses a special form of theodolite, also designed by himself, provided with a sighting attachment and a plummet, and costing only a few pence. In the experiments referred to, when comparative observations were made with both types of balloon, air currents in the opposite direction to those at ground-level were found at heights of from two to five hundred metres. Details are given of numerous observations, the information obtained embracing speed and direction of air currents, the location of upward and downward eddies in the atmosphere, height of surface currents, &c. The meteorological conditions, nature of clouds, force and direction of the wind prevailing on each occasion are also given.

In recording observations of periodic phenomena, it is very usual to make a certain number of groups of regular observations and to take the arithmetical mean of each group. In a note on the application of the method of harmonic analysis (Journal of the Meteorological Society of Japan, xxxi., 5), Mr. Y. Tsuiji shows that when the results are used for the purposes of harmonic analysis the coefficients thus obtained are too small, and formulæ and tables are given for the necessary corrections.

Under the title "Surfaces of Revolution of Minimum Resistance," Dr. E. J. Miles, writing in the Bulletin of the American Mathematical Society, discusses the form of an airship or other figure of revolution which experiences the least resistance in its motion through a resisting medium. The assumption made is that the pressure on any surface element is a function of the inclination of that element to the direction of motion, and is unaffected by the currents set up by the remaining portions of the surface, and in this respect the problem differs essentially from that presented by an airship or body moving through a material fluid medium. The problem is, however, a classical application of the calculus of variations dating back to the time of Newton.

A series of articles on the origin of the earth's magnetic field have appeared in *Terrestrial Magnetism* during the last two years from the pen of the editor of that journal, Dr. L. A. Bauer. The subject has been recently dealt with by Prof. Schuster in his address to the Physical Society of London, and by Dr. W. F. Swann in the July number of *The Philosophical Magazine*. The conclusion to which each examination leads is that none of the present theories offers a satisfactory explanation of the earth's magnetic state. In the September number of *Terrestrial Magnetism* Dr. Bauer shows that if the mean values of the magnetic elements be calculated for successive parallels of latitude between 60° N. and 60° S., these values are represented to within 1 per cent. by an expression for the magnetic potential which involves only the first and third zonal harmonics; that is, it involves the first and third powers only of the cosine of the colatitude. This fact serves as a very severe test of any theory advanced, and none of them appears capable of surviving its application.

AN interesting paper on the occurrence, analysis, and genesis of iridosmine obtained from the New Rietfontein Mines is communicated by Mr. C. Baring Horwood to vol. xv. of the Transactions of the Geological Society of South Africa. Iridosmine is an intimate mixture of iridium and osmium, found in small quantities, as small grey particles, associated with gold. Specimens microscopically examined by the author showed a decidedly crystalline character, but the metal has never been recognised *in situ* or in hand specimens; "panning" experiments show that in the New Rietfontein it chiefly occurs in a very narrow banket reef, known as the carbon leader, wherein the gold is always associated with carbon. Spectroscopic analyses, made for Mr. Horwood at the Solar Physics Observatory, South Kensington, indicate that the iridosmine is mainly composed of osmium, ruthenium, and iridium. A concentrate examined quantitatively at the Imperial Institute had a specific gravity of 19, and contained 95 per cent. iridosmine, of which 45 per cent. was iridium. The metal does not occur in paying quantities, and it took six months to collect 910 grains at the Rietfontein Mine, during which period 102,800 tons of ore were treated, and more than 52,500 oz. of fine gold were recovered. Mr. Horwood concludes that these metals of the platinum group are certainly of secondary origin, formed as primary segregations by magmatic concentration in the basic eruptives of the mines, and extracted from the dykes by active superheated gases during the pneumatolytic phase of eruptive activity. Probably, at a later stage, hydrothermal action was an important factor in concentrating them in the banket reefs.

ATTENTION may be directed to an article on isomerism by Werner Mecklenburg in *Naturwissenschaftliche Wochenschrift* for October 20. The article, which extends over ten pages, and occupies the larger part of the issue, deals with the phenomena of position isomerism, optical isomerism, stereo-isomerism, and dynamic isomerism, together with the Walden inversion and the isomeric derivatives of cobalt and other metals as investigated by Werner.

We have received from Messrs. A. Hermann et Fils a reprint of a series of lectures "Sur quelques Thèmes choisis de la Chimie Physique pure et appliquée," delivered by Prof. Arrhenius at the University of Paris from March 6 to 13, 1911. Some of the subjects are identical with those of the Silliman lectures delivered at Yale in 1911 and published recently under the title "Theories of Solution"; this statement applies to the lectures on molecular theory, on suspension and the phenomena of adsorption, and on free energy. But different ground is covered by the lectures on the atmospheres ot planets and the physical conditions of the planet Mars. The five lectures cover 112 pages, and are issued at the modest price of three francs.

THE yearly memorandum issued by Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association, deals with the relative costs of burning fuel or oil under boilers, and exploding oil or gas in engines. With the ruling prices of oil, it will not be profitable to burn it in preference to coal until the price of the latter has risen to 38*s*. per ton; but oil can be profitably used in internal-combustion engines whenever and wherever the price of coal exceeds 15*s*. per ton. The greater part of the memorandum deals with the valuable experiments of Profs. Heyn and Bauer on corrosion, or rather on the influence of about forty dissolved salts in reducing or increasing corrosion. The phenomena associated with corrosion are too erratic to permit of definite conclusions being drawn, but Mr. Stromeyer gives an excellent analysis of the experiments mentioned which will be of great service to steam users who are troubled with corrosive feed waters.

WE have before us twenty-two volumes belonging to the series "Aus Natur und Geisteswelt," published by the firm of Mr. B. G. Teubner, of Leipzig and Berlin. The series now includes nearly four hundred volumes dealing with many aspects of literature, art, music, history, law, philosophy, science, and technology. The price of each volume is one mark, or 1.25 marks in cloth covers. A distinguishing characteristic of the series is the attention given to present-day problems. Among the subjects of recent volumes, for instance, are directions of modern physics, experimental cytology, regeneration, biochemistry, milk and its products, problems of modern astronomy, astronomy in relation to practical life, surgery of our time, practical mathematics, spinning, light-railways, wireless telegraphy, aërial navigation, brewing, and kinematography. Each volume is simply written and suitably illustrated, and the whole series forms a remarkably comprehensive collection of manuals of modern thought and progress. Both the editor and publisher are to be congratulated upon the production of the volumes, which should do much to promote interest in science, art, and letters among German readers.

A NEW issue of the list of second-hand microscopes and other instruments which they have on sale has been issued by Messrs. Clarke and Page, 23 Thavies Inn, Holborn Circus, London, E.C.

A CATALOGUE of works on anthropology, ethnology, primitive society, &c., also mythology and folk-lore, including a portion of the library of Sir H. H. Risley, K.C.I.E., has just been issued by Mr. Francis Edwards, 83 High Street, Marylebone, London, W.

A second edition of Mr. A. H. Mackenzie's "Theoretical and Practical Mechanics" has been published by Messrs. Macmillan and Co., Ltd. The first edition was reviewed in our issue of May 16, 1907 (vol. lxxvi., p. 50). While the general character of the book has been preserved, the new edition has been much enlarged, and in its preparation Mr. Mackenzie has had the cooperation of Mr. A. Forster. The price of the volume remains 1*s*. 6*d*.

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## *OUR ASTRONOMICAL COLUMN.*

A New Comet, 1912*c*.—A telegram from the Kiel Centralstelle announces the discovery of a new comet by M. Borrelly at Marseilles on November 2. The position at 7h. 39·9m. (Marseilles M.T.) was:—

R.A. = 17h. 47m., decl. = 38° 57′ N.,

which lies about 2° N.W. of $\theta$ Herculis. The motion is said to be south-east, the magnitude 10, and the comet transits at about 3 p.m.

A second telegram from the Centralstelle states that the comet was observed by M. Abetti, at the Arcetri Observatory, on November 3, when its position at 7h. 7·6m. (Arcetri M.T.) was:—

R.A. = 17h. 55m. 12·8s., decl. = 37° 21′ 5″,

and the magnitude was estimated at 9·5. The position, at present, is favourable for observations during the evenings, when the comet is fairly high up in the north-west sky.

Gale's Comet 1912*a*.—Photographic observations made at the Hamburg Observatory, Bergedorf, on October 9 showed the coma of Gale's comet to be elongated in the direction of the chief tail, position angle 79°, and to be about 1·1′ in diameter; a plate taken with a 5-inch objective of 25-inch focal length showed a tail 5·4° long, which was 2′ broad until it reached about 1° from the head, and then broadened out to 11′ at a distance of 5°. A shorter tail emerged in position angle 122°, and another was suspected at position angle 50°; the magnitude of the whole comet was about 5·5.

Spectrographic observations on October 10 and 15 showed a bright image of the head at 387 $\mu\mu$ ±, and the bands at 474 and 563 $\mu\mu$, the blue band being essentially brighter than the yellow; the band at 516 $\mu\mu$ was much fainter. The continuous spectrum was much fainter than the bands named, but could be seen extending right along the spectrum from 387 to 563 $\mu\mu$, and was brightest between 397 and 410 $\mu\mu$. Prof. Schwassmann states that on the whole the spectrum obtained is very similar to that given by Kiess's comet at the beginning of July, 1911. (*Astronomische Nachrichten*, No. 4608.)

Schaumasse's Comet 1912*b*.—In No. 4609 of the *Astronomische Nachrichten*, M. Fayet shows that if the comet recently discovered by M. Schaumasse is not identical with Tuttle's comet, the two objects are moving in very similar orbits. If the identity is accepted, there is an error of about 5° in the mean anomaly, and nearly 4″ in the mean motion, according to M. Raht's elements for Tuttle's comet as given in these columns last week. A tentative calculation by M. Fayet does not indicate the near approach of the comet to any great planet during the recent revolution, and he suggests the possibility that the comet may have split up, the object discovered by M. Schaumasse being only one part. It would be of interest to search for the main body near the calculated positions given in M. Milićević's recently published ephemeris; on October 20 the position of comet 1912*b* was $\alpha = 10$h. 3m., $\delta = -0°$ 43, whereas the ephemeris position for Tuttle's comet was $\alpha = 9$h. 37m., $\delta = +73°$ 27′.

In a later note (*Astronomische Nachrichten*, No. 4610), M. Fayet states that he finds that near the end of 1900 Tuttle's comet was near Jupiter, the minimum distance being 0·8, and a rough calculation gives October 9, 1912, as the resulting date of perihelion passage, three months earlier than the date indicated by the 1899 orbit; the new value for the mean motion ($\mu$) is 263·94″. M. Fayet concludes that the identity of 1912*b* with Tuttle's comet is very probable, but his hurried calculations of the Jovian perturbation are necessarily only approximate. M. Schaumasse's new ephemeris gives the following positions and distances:—

*Ephemeris 12h. (M.T. Paris).*

| 1912 | $\alpha$<br>h. m. | $\delta$<br>° ′ | log $r$ | log $\Delta$ |
|---|---|---|---|---|
| Nov. 7 | 10 54·5 | −22 2 | | |
| 11 | 11 6·7 | −26 27 | 0·0371 | 0·1040 |
| 15 | 11 19·1 | −30 41 | | |
| 19 | 11 31·9 | −34 39 | 0·0536 | 0·1218 |

Sundials.—Several interesting articles on sundials are published in the October number of *L'Astronomie*. M. Roguet describes an elaborate dial recently erected on the south façade of Juvisy Observatory, and also discusses the history of this instrument, which he believes was invented about 550 B.C.; this article is illustrated by several interesting photographs and diagrams, the former depicting a large number of ancient, or especially interesting, dials. M. d'Aurelle Montmorin describes the "Auto," a new portable sundial, and M. Joyeux gives an interesting and detailed description of the sundial erected on the communal school at Sèvres.

Variability of Solar Radiation.—Mr. C. G. Abbot, director of the Smithsonian Astrophysical Observatory at Washington, has just returned from a five months' astronomical expedition to Bassour, Algeria. The object of the expedition was to confirm or disprove the supposed variability of the sun. The Astrophysical Observatory has been for seven years making observations on Mt. Wilson, in California, on the daily quantity of heat received from the sun. The observations are arranged in such a manner as to indicate not only the quantity of solar heat reaching the earth, but also the quantity of heat which would reach a body like the moon, which has no appreciable atmosphere.

The observations have indicated that the sun is probably a variable star having a range of variation amounting to from 5 to 10 per cent. within an irregular interval of from five to ten days. Last year Mr. Abbot observed in Algeria, while his colleague, Mr. Aldrich, observed on Mt. Wilson, in California. The object of thus duplicating the measurements was to avoid being misled by any local atmospheric conditions which might have affected Mt. Wilson observations. As nearly one-third of the circumference of the earth lies between Mt. Wilson and Algeria, it could not be expected that a similar local disturbance could affect both stations on the same day in the same manner. The observations of 1911 supported the belief that the sun is variable, but owing to cloudiness their number was not sufficient fully to establish this point. Hence it was thought best to return to Algeria this year.

The observations made by the Smithsonian party in Algeria this year were apparently very satisfactory. They occupied sixty-four days, and on more than fifty of these days Mr. Fowle made similar observations on Mt. Wilson, in California. The results of the work of 1911 and 1912 are expected to establish the supposed variability of the sun, or to show conclusively that this hypothesis can no longer be held.